iv) eliminated the lack of antecedent support for the term "metal binder" in claim 9 by replacing it with --bonding metal-- as suggested by the Examiner.

These amendments should eliminate the bases for each of the Examiner's rejections under 35 USC 112.

B. 35 USC 103 Rejection

The Examiner premises an "obviousness" rejection under 35 USC 103 upon the article by Toyota et al published in Vol 41, Number 2, of the Japanese Journal of Tribology (1996) (hereinafter, Toyota Part 2). The copy of the article furnished to the Applicant by the Examiner with the 10/20/96 office action was in the Japanese language. Only the title and abstract had been translated into English in any of the materials furnished by the Examiner. Therefore, applicant has obtained an English language translation of the article from Allerton Press, Inc., and attaches it as Attachment 2 to this Amendment B.

Applicant has also located a slightly earlier article by the same authors published in the Japanese Journal of Tribology Vol 40, Number 12 (1995) (hereinafter, "Toyota Part 1"). Applicant has obtained an English language translation of that article from Allerton Press, Inc. and attaches it as Attachment 1 to this Amendment B. Toyota Part 1 is Part 1 of the same article upon which the Examiner bases the 35 USC 103 rejection, Toyota Part 2.

Toyota Part 2 reports friction and wear properties of Ni-Co-Cr-Al-Y bonded $Cr_2O_3$ with fluoride additions. Toyota Part 1 reports a coating of Ni-Co-Cr-Al-Y binder with $Cr_2O_3$, Ag, $BaF_2$, and $CaF_2$ additions.

While there are similarities between the work reported in the Toyota articles and the instant invention, those similarities go little beyond the topic depicted in the article titles. Distinct and

important differences exist which explain why the coatings reported by Toyota fail to perform, as the Toyota article itself notes, Toyota Part 1, pp 1283 para. 3, while the instant invention exhibits vastly superior performance which would not be expected based upon Toyota's teachings. The key differences and unobvious advantages of the instant invention are a more informed choice of binder, prefused processing of the fluorides, and the selection of proper volumetric proportions of the constituents. The Toyota publications themselves evidence that those differences are not obvious to one of ordinary skill in the art, because Toyota did not teach them.

The coatings described by Toyota teach the wrong bonding agent which causes high temperature degradation. The Toyota binder contains 12.5 atomic %, which is nearly 35 volume %, of aluminum. At elevated temperatures, aluminum readily reacts with $BaF_2$ and $CaF_2$ by stripping away the F atoms leaving free Ca + Ba to react with the Cr and $Cr_2O_3$ permanently degrading the tribological properties of the coating. Toyota refers to this as the "hysteresis phenomenon". (Toyota Part 1 pp 1285 par. 1.) Toyota does not seem to recognize that this chemical reaction causes a permanent performance degradation, referred to as hysteresis by Toyota, which is undesirable for a successful durable solid lubricant. In contrast, the claimed invention contains only NiCr or CoCr as a binder, thereby eliminating the chemical degradation process to which Toyota's teaching leads. Specification pp. 3, para. 1 and pp. 4 , para. 2.

The coatings taught by Toyota contain 80% by volume, which is 84% by mass, of binder, with only 20% by volume lubricant and hardeners, such as Ag, $BaF_2$, $CaF_2$, and $Cr_2O_3$. (Toyota Part 1, pp. 1279, para. 1 and Toyota Part 2, pp. 128, para. 3). This level of binder is too high to provide adequate lubrication and wear resistance, which explains why Toyota's reported friction and wear properties were poor especially at temperatures below 300°C. By contrast, the claimed invention contains only 20 to 60% by volume of binder, 20 to 60% hardener, and 10-20% lubricants. (Specification at p. 8 , Table 2; and p. 12 claim 12.)

Toyota teaches a simple mixture or blend of fluoride powders with the (eutectic) $BaF_2$ /$CaF_2$ atomic or mass ratio in an attempt to verify work done by Sliney in the literature. (Toyota Part 1, p. 1282, para. 1). Completely absent is any teaching which could provide more than a hope to serendipitously form the desired eutectic fluoride composition in the coating. Compared to other proportions of $BaF_2$/$CaF_2$ or the individual fluorides, the eutectic composition, originally reported by Sliney and referenced by Toyota Part 1 as ref. #8, exhibits better lubrication properties due to its intrinsically lower shear strength at a given temperature. However, to achieve regions or pockets of eutectic fluoride in the final composite, the fluorides must be prefused and reground in the powder processing step as taught by our claimed invention. This prefusing and regrinding process is also used to yield the appropriate particle size of 44-70 microns of the fluoride which aides the deposition process.

Set forth as Attachment 3 is a chart which compares key features of the present invention to the teachings of Toyota. This comparison demonstrates that Toyota made different, and in retrospect, poor, technical decisions regarding binder composition, fluoride processing, and coating constituent proportions. These decisions lead Toyota down different research paths than those taken for the instant invention. The Toyota paths yielded an inferior product when compared to the claimed invention, the performance of which is shown in Table 3 of the specification. The superior results obtained by the Applicant are totally unexpected, and therefore unobvious, based solely upon the teachings of Toyota. It requires superior research and expertise in areas unexplained by Toyota to achieve the claimed invention.

For the above stated reasons, it is submitted that the rejection based upon 35 USC 103 should be withdrawn , and the application now found in condition for allowance.

Respectfully submitted,

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